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CRUDE OIL AND GASOLINE PIPE LINES IN THE UNITED STATES, MAY 1, 1941

BY

G. R. HOPKINS AND F. S. LOTT

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UNITED STATES DEPARTMENT OF THE INTERIOR - BUREAU OF MINES

CRUDE-OIL AND GASOLINE PIPE LINES IN THE UNITED STATES MAY 1, 1941[1]

By G. R. Hopkins[2] and F. S. Lott[3]

TOTAL MILEAGE

Crude-petroleum pipe lines in the United States on May 1, 1941, had a total length of 118,350 miles - an increase of 7,770 miles since June 30, 1936, when the last previous survey was made by the Bureau of Mines. The expansion was due almost entirely to trunk-line construction, as the mileage of gathering lines was virtually unchanged from 1936. The greatest mileage of gathering lines, 53,640, was recorded in the survey of May 1, 1931. Both trunk- and gathering-line mileage decreased moderately in the interval from 1931 to 1936, but the present survey indicates that trunk-line facilities have expanded since 1936 to new high levels. Trunk-line mileage equaled 55 percent of the total mileage of all crude lines on May 1, 1941, and 52 percent in 1936.

The total length of gasoline pipe lines on May 1, 1941, was 9,001 miles; this does not include several hundred miles of line under construction at that time or several hundred additional miles now being laid. No detailed surveys of gasoline mileage were made for May 1, 1931, and June 30, 1936, but the mileage for those dates was about 1,400 and 4,600, respectively.

DIAMETERS OF PIPE LINES

The average diameter of trunk pipe lines for crude oil, as indicated by calculating cubic content and length relationships, increased to 8.4 inches on May 1, 1941, from 8.3 inches on June 30, 1936, and 8.0 inches on May 1, 1931. It will be noted in the attached table 2, which summarizes the mileage of various sizes of pipe in use, that the amount of 4-inch and smaller pipe in trunk lines decreased while the mileage of all larger sizes increased. Pipe of 8-inch and larger diameter equaled 74 percent of total trunk-line mileage in 1941 and 73 percent in 1936.

In the latest survey, gathering lines were not reported by sizes. However, the trend toward greater use of 4- and 6-inch sizes for gathering was evident before 1936, and probably has continued to the present time.

1/ The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is used: "Reprinted from Bureau of Mines Information Circular 7196."

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The diameter of gasoline lines ranges from 2 to 12 inches, with 6- and 8-inch predominating. The weighted average diameter was 7.0 inches.

PIPE-LINE FILL

For the 1936 survey, which was made in connection with a special study of crude oil in storage, the actual volume of crude oil contained in trunk and gathering lines was reported as 21,533,000 barrels. The calculated volumetric capacity of all lines then in the ground was 24,540,000 barrels. The accompanying table 1 shows, in columns 9 and 10, these theoretical cubic capacities separately for trunk lines and gathering lines, by States. The trunk-line data for 1941 (column 4) are comparable to the volumes of line fill for trunk lines in 1936 (column 9). The gathering-line fill is not available in the latest survey, as data on line sizes were lacking.

The cubic capacity of the gasoline lines was 2,235,000 barrels, indicating an actual content of just under 2,000,000 barrels.

PRINCIPAL CHANGES IN CRUDE-OIL PIPE LINES

Trunk pipe-line facilities increased in most States. Texas, with over 2,500 miles of new line since 1936, continued to lead other States by a substantial margin. Important growth took place also in Illinois and Kansas, where many new prolific oil pools were discovered. Several of the major pipe-line systems, which carry oil from southwestern fields to refineries in the North Central States as far east as Ohio, found it necessary to lay new lines to meet larger demands. As much of the new production developed in Louisiana is in the southern part and convenient to water transportation, pipe-line construction there has not kept pace with the enlarged output.

A sharp expansion in Wyoming trunk lines resulted from construction of two new lines to carry oil from eastern Wyoming fields to refineries at Salt Lake City, Utah, and Denver, Colo. These are the first major oil pipe lines to be placed in service in Utah and Colorado.

Following rather sharp curtailment of pipe-line facilities in California in the 1931-36 period, construction revived, with increasing oil production. Several major lines were built to bring oil to tidewater from inland fields and to refineries in the San Francisco area.

Mileage of trunk lines in Oklahoma has declined rather sharply since the peak established in 1931. However, since 1936 there has been a moderate increase in the amount of 10- and 12-inch pipe in use. There were small reductions in trunk-line mileage in Arkansas and north Louisiana, New Jersey, and Pennsylvania.

Gathering-line mileage increased of necessity in States that have been the scene of aggressive development since 1936 - notably Illinois, Texas, New Mexico, California, and Michigan - and tended to decline in areas where settled production from oil fields is the dominant factor.

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A severe strain was placed upon all available facilities for moving petroleum and products to the eastern seaboard in the late spring and summer of 1941. Expanding markets which accompanied the vast national defense program were threatened with a shortage of supply when approximately 80 tank ships were transferred from coastwise trade to British use. As a result, shipments through the old trunk lines from Illinois eastward to tidewater were increased, and a number of rehabilitation and construction projects were carried out. An important new line from Portland, Maine, to Montreal, Canada, is expected to commence oil runs in November. The stress was definitely relieved late in October, when the announcement was made that the British were returning a number of the tankers to domestic service.

The first gasoline pipe line to go in operation was that of the Tuscarora Oil Co., Ltd., in Pennsylvania in the latter part of 1930. This was formerly a crude-oil line which was converted into a line to move gasoline in the opposite direction, that is, from east to west. Three other large systems, the Great Lakes, Phillips, and Susquehanna, were placed in operation in the spring of 1931. Since then newcomers have numbered about one a year with most of the new construction representing extensions and looping of the established systems. New work was stimulated by potential shortages in gasoline supply in the East Coast, Appalachian, and Indiana-Illinois districts, and roughly 500 miles of gasoline line have been laid in 1941 with possibly that much under construction at the present time.

TECHNICAL DEVELOPMENTS

Evolutionary changes in the techniques of oil pipe-line construction, operation, and maintenance have substantially improved efficiencies in recent years and reduced such costs as are subject to control by pipe-line companies.

In the construction field, aerial surveys have become standard practice on long lines for rapidly and economically determining the most advantageous right-of-way.

With the change from couplings for joining lengths of pipe to the modern practice of welding have come better pipe of seamless or electric-welded, high-tensile steel in 40-foot or "double" lengths, factory-made pipe bends, and power machines that apply protective coatings to pipe in the field. These changes tend to reduce the time and cost of new construction and produce a superior pipe line less subject to corrosion and leakage and easier to recondition.

Operating pressures as high as 2,000 pounds have been achieved with safety by the use of forged steel fittings, cast alloy-steel valves, and stronger materials in compressor cylinders and other parts under stress. Common practice in earlier years was to use cast iron for this equipment. High-pressure construction on some new trunk lines has permitted an increase in the distance between pump stations to 100 to 200 miles from the former practice of 40- to 60-mile intervals.

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At small stream crossings lines are commonly suspended above the water rather than buried beneath it. By this means, unnecessary trouble from washouts and corrosion is avoided.

The efficiency of field gathering-line systems has been raised by the modern practice of installing small, automatic pump stations, which eliminate the need for pump houses and are easily moved as conditions change.

Although still in the pioneering stage of development, synchronized operation of all stations along a trunk line has proved advantages that promise its wide use on long lines. The system permits better pressure control and prompt detection of line losses, and eliminates the need of "floating" tanks at pump stations.

Dependable oil meters have been developed in recent years, suitable for some pipe-line purposes. They are finding an increasing field of usefulness, particularly in California, both for measuring quantities of oil and for checking oil losses from pipe-line systems.

An important step toward reduced maintenance costs of prime movers at pump stations has been the adoption of closed systems for cooling water. By their use much expense and shut-down time are avoided through control of scale formation and of corrosion in cylinder jackets. Wear of moving parts has been greatly retarded by removing foreign matter from lubricating oils and fuels by filtering and centrifuging before injection into machinery.

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TABLE 1. - Mileage of crude-oil pipe-lines in the United States, May 1, 1941, and June 30, 1936, by States

State	May 1, 1941					June 30, 1936				
	Trunk lines (miles)	Gathering lines (miles)	Total miles	Trunk-line fill (1000's of bbl.)	Gathering-line fill (1000's of bbl.)	Trunk line (miles)	Gathering lines (miles)	Total miles	Trunk-line fill (1000's of bbl.)	Gathering-line fill (1000's of bbl.)
Arkansas	580	600	1,180	184		650	650	1,300	202	66
California	3,590	2,220	5,810	1,280		2,680	1,770	4,450	1,018	311
Colorado	115	90	205	18		20	100	120	3	7
Illinois	4,280	1,850	6,130	1,910		3,110	940	4,050	1,353	58
Indiana	2,490	280	2,770	1,025	Not	1,980	280	2,260	738	26
Iowa	95	-	95	55		100	-	100	55	-
Kansas	4,930	4,040	8,970	1,662		3,770	3,910	7,680	1,229	375
Kentucky	500	1,310	1,810	56	avail-	430	1,340	1,770	47	49
Louisiana	1,970	1,320	3,290	713	able	2,200	1,100	3,300	734	116
Michigan	870	430	1,300	189		490	250	740	116	16
Mississippi	-	20	20	-		-	-	-	-	-
Missouri	4,610	-	4,610	2,302		4,180	-	4,180	1,948	-
Montana	140	350	490	15		100	350	450	15	28
Nebraska	380	10	390	253		390	-	390	255	-
New Jersey	110	-	110	28		180	-	180	39	-
New Mexico	450	900	1,350	150		300	450	750	80	48
New York	290	600	890	45		200	550	750	22	18
Ohio	2,630	4,940	7,570	870		2,360	5,620	7,980	694	266
Oklahoma	9,040	10,280	19,320	2,804		10,170	11,510	21,680	2,847	1,020
Pennsylvania	3,390	5,690	9,080	625		3,470	5,810	9,280	649	186
Tennessee	-	-	-	-		-	10	10	-	-
Texas	22,870	13,420	36,290	8,762		20,290	12,600	32,890	7,972	1,318
Utah	80	-	80	22		-	-	-	-	-
West Virginia	330	4,480	4,810	54		260	4,820	5,080	53	275
Wyoming	1,440	340	1,780	426		490	700	1,190	149	139
Total U.S.	65,180	53,170	118,350	23,448		57,820	52,760	110,580	20,218	4,322

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TABLE 2. - Mileage of crude-oil pipe lines in the United States, June 30, 1936, and May 1, 1941, by sizes

Size (I.D.)[1]	Trunk lines (Miles)		Gathering lines (Miles)		Total (Miles)	
	May 1, 1941	June 30, 1936	May 1, 1941	June 30, 1936	May 1, 1941	June 30, 1936
2-inch.....	-	-	Not available	19,620	Not available	19,620
3-inch.....	-	-		9,220		9,220
Below 4-inch..	1,050	1,270		-		1,270
4-inch.....	3,590	3,990		13,550		17,540
6-inch.....	12,570	10,460		7,680		18,140
Above 6-inch..	-	-		2,690		2,690
8-inch.....	29,380	27,060		-		27,060
10-inch.....	11,710	9,450		-		9,450
12-inch.....	6,710	5,510		-		5,510
Above 12-inch.	170	80		-		80
Total U. S....	65,180	57,820	53,170	52,760	118,350	110,580

1/ Data for odd sizes are included in next smaller size listed.

TABLE 3. - Mileage of gasoline pipe lines in the United States, May 1, 1941, by States and sizes

State	Miles	Size (I.D.)	Miles
Connecticut.....	22		
Florida.....	78	2-inch	7
Georgia.....	380		
Illinois.....	807		
Indiana.....	222	3-inch	155
Iowa.....	919		
Kansas.....	1,155		
Louisiana.....	45	4-inch	692
Massachusetts...	153		
Michigan.....	70		
Minnesota.....	248	5-inch	24
Missouri.....	573		
Nebraska.....	203		
New Jersey.....	149	6-inch	3,757
New York.....	527		
Ohio.....	479	8-inch	4,230
Oklahoma.....	606		
Pennsylvania....	1,729	10-inch	68
Rhode Island....	17		
South Dakota....	24		
Texas.....	595	12-inch	68
Total U. S.	9,001		9,001

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